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# (54) Water soluble wood preservative

(57) There is provided a water soluble wood preservative, which is also an excellent fire retardant, consisting of a strong solution of sodium octaborate which has been compounded in aqueous solution with non-ionic surfactants and thickeners, e.g. sodium carboxymethyl cellulose, the latter allowing for thick film application by brush but primarily present so that the preservative layer on the wood is self-skimming and is therefore evaporation retarded or slow drying. Such water soluble wood preservatives can also contain other fungicides like sodium fluoride or sodium pentachlorophenate but the main reason for the presence of the octaborate is bifunctional in that it is both a wood preservative and a flame retardant.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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# WATER SOLUBLE BORON WOOD PRESERVATIVES

Boron wood preservatives are now almost entirely based on the octaborates because of the superior water solubility which they exhibit when compared with other related salts such as borax.

At ambient temperatures solutions of octaborates, as high as 7% $B_2O_3$, are employed but up to the present their use has been restricted to the treatment of raw timber where the high inherent moisture content of the wood can give useful penetrations by the diffusion process. However once the wood has been seasoned, or kiln dried, the gums and starchy constituents of the sap dry off and offer an impenetrable barrier to strong electrolytes like borate solutions.

Experiments have shown that kiln dried timber can be penetrated by solutions of sodium octaborate but diffusion times are long and at first sight would seem to be only satisfied by immersion for some hours.

Further experiments in this system have shown that some penetration, about 1mm depth can be accomplished if octaborate solutions are combined with surfactants so that the overall surface tension of the mixture is reduced. Further it has been established that penetration

properties of borate solutions can be enhanced by incorporating primary alcohol ethoxylates in the borate solution and this can be accomplished, by proper selection of the surfactant, so that salting out in the strong electrolyte does not occur.

Not all non-ionic surfactants are suitable for use with octaborate preservatives and a preferred one is known as nonidet. LG (Trade Mark) which is a primary alcohol ethoxylate with 8 moles of ethylene oxide per mole of fatty alcohol. As this work continued it was also found that the incorporation of an anionic surfactant such as dodecylbenzene sulphonate had the special effect of allowing the Nonidet (trade mark) spiked borate solutions to penetrate a little less into the wood with the result that greater concentrations of $B_2O_3$ accumulated on the surface skin of the wood and completely prevented afterglow in fire tests.

After much research work it was established that whilst the above innovations were useful for both preservative and fire-proofing measures for kiln dried wood the full commercial advantages of the treatment could not be achieved unless the final penetration of the ingredients was at least 2mm and preferably 3mm in depth.

It has now been shown, after many tests, that the reason penetrations of 2 to 3 mm in depth cannot be achieved by spray or brush application of octaborate solutions, even those containing the surfactants mentioned above, is that the films dry out quickly and the surface diffusion process ceases.

It is obvious that good penetrations of octaborates can be achieved in kiln dried wood if the samples are immersed in the preservative solutions but this, of course, destroys the effects of drying and leads to gross distortion of the wood. On the otherhand, brush or any other type of surface application of the octaborate solution will not distort the wood, but such films dry out too quickly so that diffusion of the borate to useful depths of 2 to 3 mm are not achieved.

The disadvantages recorded above are overcome in the invention described herein where it will be seen that by employing its teachings it is possible to produce a product consisting of an aqueous solution of sodium octaborate containing the anionic and non-anionic surfactants described in a manner where the rate of evaporation of the water in the solution is so retarded that drying times of 8 to 30 hours can be achieved.

During this time the full diffusion process of octaborate from the surface of the timber to the interior can proceed and commercially useful penetrations of 2 to 3 mm can easily be obtained.

In order to achieve this effect use is made of the fact that polymer thickened aqeous solutions have their rates of evaporation greatly restricted when exposed to the air because of the self skinning properties of the aqeous polymer solution. For example it is well known that thickened water, with or without surfactants, has a long period of atmospheric exposure before it can evaporate to dryness and this effect is used greatly in the employment of 1% solutions of carboxymethyl cellulose as liquids for wallpaper stripping. In using this innovation in conjunction with the knowledge gained in the previously described work of adding mixed surfactants to octaborate solutions it has been established that in carrying out the teachings of this described invention it is no longer necessary to use an anionic surfactant with the Nonidet LG (Trade Mark) because the thickening agents used, preferably sodium carboxymethyl cellulose, behave as the required anionic species.

In this work it has been found that the mixtures described above are compatible with alkali metal fluorides and since these are excellent fungicides and insecticides it is possible to incorporate these in the formula which represent the teachings of the invention. In the case of the fluoride addition it is preferable to restrict its concentration to about 1% weight for weight as this is sufficient for all purposes and has the advantage of keeping the product out of the range of fluoride concentrations which are covered by the Poisons Acts of the United Kingdom.

The following formula is quoted by way of example and it illustrates the use of a preferable grade of sodium carboxymethyl cellulose which is sold as Courlose 1000G (Trade Mark) by the Courtauld's Group. Polybor is a trade mark for sodium octaborate tetrahydrate.

Example:-

| | |
|---|---|
| Polybor (Trade Mark) | 10% w/w |
| Sodium Fluoride | 1% w/w |
| Nonidet LG (Trade Mark) | 0.12% w/w |
| Courlose 1000G (Trade Mark) | 2.95% w/w |
| Water | to 100 grams |

When the above solution is spread or painted unto a kiln dried wood surface there is rapid absorption in the first minute of contact and the surface appears so dry that a second coat can be applied within a short period of some minutes afterwards.

If a second coat of the solution is now applied to the surface little absorption takes place and it can take up to 24 to 30 hours for the film to become touch dry. During this period the solutes in the preparation remain in solution, due to retardation of water evaporation by the self-skinning effect of the carboxymethyl cellulose, and this allows diffusion of the preservative salts into the capillaries of the wood in a fashion which previously could only be achieved by total immersion of the sample.

Further it has been found that carboxymethyl cellulose remains on the surface of the wood as a dried adhesive film which acts as a size for painting or finishing purposes and bonds dried-out, or microcrystallised octaborate, on the wood surface which renders it fireproof as regards spread of flame or afterglow.

The treated wood therefore has a flameproof surface and below this there is a toxic 2 to 3 mm depth of octaborate and fluoride which is both insecticidal and fungicidal.

Others skilled in the art will appreciate that once the innovation of evaporation retardation by water soluble polymers is understood in the context of water borne preservatives and fire retardants it will be possible to vary the formulations by the incorporation of other types of biocidal additives, for example, pentachlorophenol as its alkali metal salts.

# CLAIMS

1. A water soluble wood preservative, based on sodium octaborate and other fungicides, and which contains sufficient sodium carboxymethyl cellulose in order to render the coatings of the solution self-skimming so that their drying-out time is greatly extended.

2. A water soluble wood preservative as in Claim 1 where the solution contains a penetration aid in the form of a non-ionic surfactant of the ethoxylated primary alcohol type.

3. A water soluble wood preservative as in Claims 1 and 2 in which the sodium octaborate is present up to its saturation concentration at ambient temperatures (15°C), but preferably at 10% weight for weight on the final solution and also where the non-ionic surfactant is present up to a concentration of 0.5%, but preferably 0.12% weight for weight, in the final solution.

4. A water soluble wood preservative as in Claim 1 where the evaporation retarder is present in the final solution at a concentration of 2.5% to 3.5%, preferably 2.95% based on a weight for weight basis on the final solution and where the cellulose derivative is preferably of a type known as Courlose 1000G (TM).

5. A water soluble wood preservative as in Claim 1 where another simultaneously present fungicide is sodium fluoride which can be present up to 3%, but preferably, 1% on a weight for weight basis calculated on the final solution.

6. A water soluble wood preservative as in Claim 1 where another fungicide is pentachlorophenol, present as its alkali metal salt, and at concentrations between 1% and 5%, preferably 2% on a weight for weight basis calculated on the final solution.

7. A water soluble wood preservative as in any of the above Claims where the slow evaporation of the solution yields a penetration of the chemicals to a depth of 2mm to 3mm into the wood but at the same time retains enough polyborate crystals in the carboxymethyl cellulose film to render the treated wood surface flameproof or fireproof.

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